REMARKS

The specification and the drawings have hereby been amended to more clearly describe the invention and to correct typographical errors. No new matter has been added by way of the amendments.

In the Office Action, claims 107-122 were rejected under 35 U.S.C. § 103(a) as being obvious over U.S. Patent No. 5,877,851 to Stann et al. Further, claim 107 was rejected under 35 U.S.C. § 103(a) as being obvious over U.S. Patent No. 4,748,634 to Hesterman.

MPEP § 2143 sets the following standard for a finding of obviousness:

> To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.
>
> The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991).

As detailed below, the Stann and Hesterman references do not support a *prima facie* case of obviousness against the claimed subject matter. In particular, the Stann reference teaches away from the claimed subject matter and both the Stann and Hesterman references do not teach all the claimed limitations. Given the teachings of the respective cited references, a *prima facie* case of obviousness has not been established.

Claim 107 was rejected under 35 U.S.C. § 103(a) as unpatentable over the Stann reference. Claim 107 recites a method of efficiently driving a laser diode comprising:

providing a wideband input signal;

providing a power amplifier with a low output impedance suited to drive a laser diode;

generating a wideband output current from the wideband input signal to modulate the laser diode;

operating the power amplifier as a voltage-controlled current driver for the laser diode.

The wideband input signal in claim 107 is a digital signal. Specification, page 22, line 7. In contrast, the Stann reference teaches the use of chirp signal which is an analogue signal. Col. 2, ll. 48-51. The chirp signal, as defined in the Stann reference, is a sinusoidal waveform with a frequency that linearly increases over a period T. Col. 2, ll. 52-54. Such a chirp signal is inherently analogue and not digital, as is the wideband signal of claim 107.

Stann further teaches that the chirp signal requires a subcarrier frequency for the system to operate as described. Specifically, the chirp signal required by Stann uses an amplitude modulated signal which includes a radio-frequency subcarrier that is itself frequency modulated. Col. 1, ll. 17-25. Stann teaches that such a signal is necessary to achieve scannerless three-dimensional imaging of a scene. Importantly, Stann does not teach any method of modulating the laser that would be more efficient than any other method, as Stann is directed to achieving a scannerless three-dimensional imaging system using ladar and the laser modulation process described therein is merely adopted from other prior art.

Stann also teaches that a wideband matching circuit is disposed between the wideband RF power amplifier and the laser diode for impedance matching purposes. Col. 3, ll. 14-17. The impedance matching described by Stann has two results, the first being that it generates a beam intensity that is highly amplitude modulated. Col. 3, ll. 18-21. The second result is that the impedance matching circuitry inherently drains the power of the power amplifier, resulting in less power being available to drive the laser diode. Stann therefore teaches that the impedance matching circuitry is necessary for the proper functioning of the disclosed system and that any wideband power amplifier may drive the laser diode, regardless of its output impedance, because the wideband matching circuit compensates for differences in impedance between the power amplifier and the laser diode. Thus, Stann does not teach that the matching circuitry may be completely eliminated or that one form of matching circuitry is preferable over another, i.e. matching circuitry that does not assist in generating the amplitude modulation.

In contrast, claim 107, includes the limitation that the power amplifier is specifically selected to have a low output impedance for purposes of driving the laser diode. Claim 107 also includes the limitation that the power amplifier is operated as a voltage-controlled current driver for the laser diode. By employing a power amplifier with a low output impedance, the need for matching circuitry may be eliminated in instances where the output impedance of the power amplifier is chosen to match the impedance of the laser diode. Alternatively, if the output impedance of the power amplifier is close to the impedance of the laser diode, the matching circuitry would drain little power, resulting in more power being available to drive the laser diode. Stann does not teach the use of a power amplifier with a low output impedance to drive the laser diode. Nor does Stann teach that the matching circuitry may be completely eliminated or how, in those instances where matching circuitry is required, the choice of a power amplifier with low output impedance dictates the requirements of the matching circuitry and the overall effect of the matching circuitry on the power output of the laser diode. Finally,

Stann does not teach that the power amplifier may be used as a voltage-controlled current driver to drive the laser diode.

For the above reasons, the Stann reference teaches away from and does not teach all the limitations of claim 107. Even when combined with the knowledge of one skilled in the art, the Stann reference does not establish a *prima facie* case of obviousness over claim 107.

Claim 108 is dependent from claim 107 and includes the additional limitation of selecting minimum, maximum, and average power levels for the laser diode, and modulating the current to the laser diode to cause the laser output to vary between the selected minimum and maximum. The Stann reference teaches an analogue signal with the power output of the laser diode proportional to the driving current derived from the analogue signal. Because Stann teaches an analogue signal, Stann does not teach selecting minimum, maximum, and average power levels for the output of the laser diode. The output of the laser diode in the Stann reference is dictated wholly by the characteristics of the analogue signal, and not by any selected minimum and maximum. The Stann reference therefore does not establish a *prima facie* case of obviousness over claim 108.

Claims 109 and 110 are dependent from claim 107, and for the reasons stated above, the Stann reference does not establish a *prima facie* case of obviousness over claims 109 and 110.

Claim 111 is dependent from claim 108 and includes the additional limitation that modulation of the power amplifier output causes the laser drive current to swing from nearly off to the desired output power with an optical extinction ratio of at least 10:1. Again, the Stann reference teaches an analogue signal with the power output of the laser diode proportional to the driving current derived from the analogue signal. Because Stann teaches an analogue signal, Stann does not teach that the laser drive current swings from nearly off to the desired output power. An analogue signal, such as

that described in Stann, must be always on to function as described. The Stann reference therefore does not establish a *prima facie* case of obviousness over claim 111.

Claim 112 is dependent from claim 107 and includes the additional limitation of providing adaptive control of the output power of the laser driver. Stann teaches that the current level of the power amplifier is varied proportionately to the analogue input signal. Mere variance of the current level, however, is not adaptive control of the output power. Stann does not in fact teach any adaptive control over the output power. The Stann reference therefore does not establish a *prima facie* case of obviousness over claim 112.

Claims 113-122 are all ultimately dependent from claim 107, and for the reasons stated above, the Stann reference does not establish a *prima facie* case of obviousness over claims 113-122.

Claim 107 was also rejected as obvious over the Hesterman reference. The Hesterman reference, however, does not teach a wideband input signal, use of a laser diode, or modulation of the laser diode using a wideband output current. The pumping system taught by Hesterman is directed towards driving high pressure gas lasers, Col. 1, ll. 11-14, and not towards driving laser diodes as is claim 107. Additionally, the input signal taught by Hesterman is sinusoidal, which has what is effectively a zero bandwidth signal. The laser is started by supplying the input signal at a first frequency that is at a resonant frequency of the laser cavity. Col. 2, l. 48 – Col. 3, l. 35. Following ignition, the frequency of the input signal is shifted to a second frequency which is more appropriate to sustain efficient operation of the laser. Col. 3, ll. 36-50.

Further, as with the Stann reference, Hesterman teaches that a impedance matching circuit is required to match the output impedance of the power amplifier with the input impedance of the laser. Col. 3, ll. 22-27.

For the above reasons, the Hesterman reference teaches away from and does not teach all the limitations of claim 107. Even when combined with the knowledge of one skilled in the art, the Hesterman reference does not establish a *prima facie* case of obviousness over claim 107.

Based on the foregoing, reconsideration of the rejections is requested.

Respectfully submitted,

FULBRIGHT & JAWORSKI L.L.P.

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By: ______________________
David M. Morse
Reg. No. 50,505

Fulbright & Jaworski L.L.P.
865 South Figueroa Street
Twenty-Ninth Floor
Los Angeles, California 90017-2576
(213) 892-9200

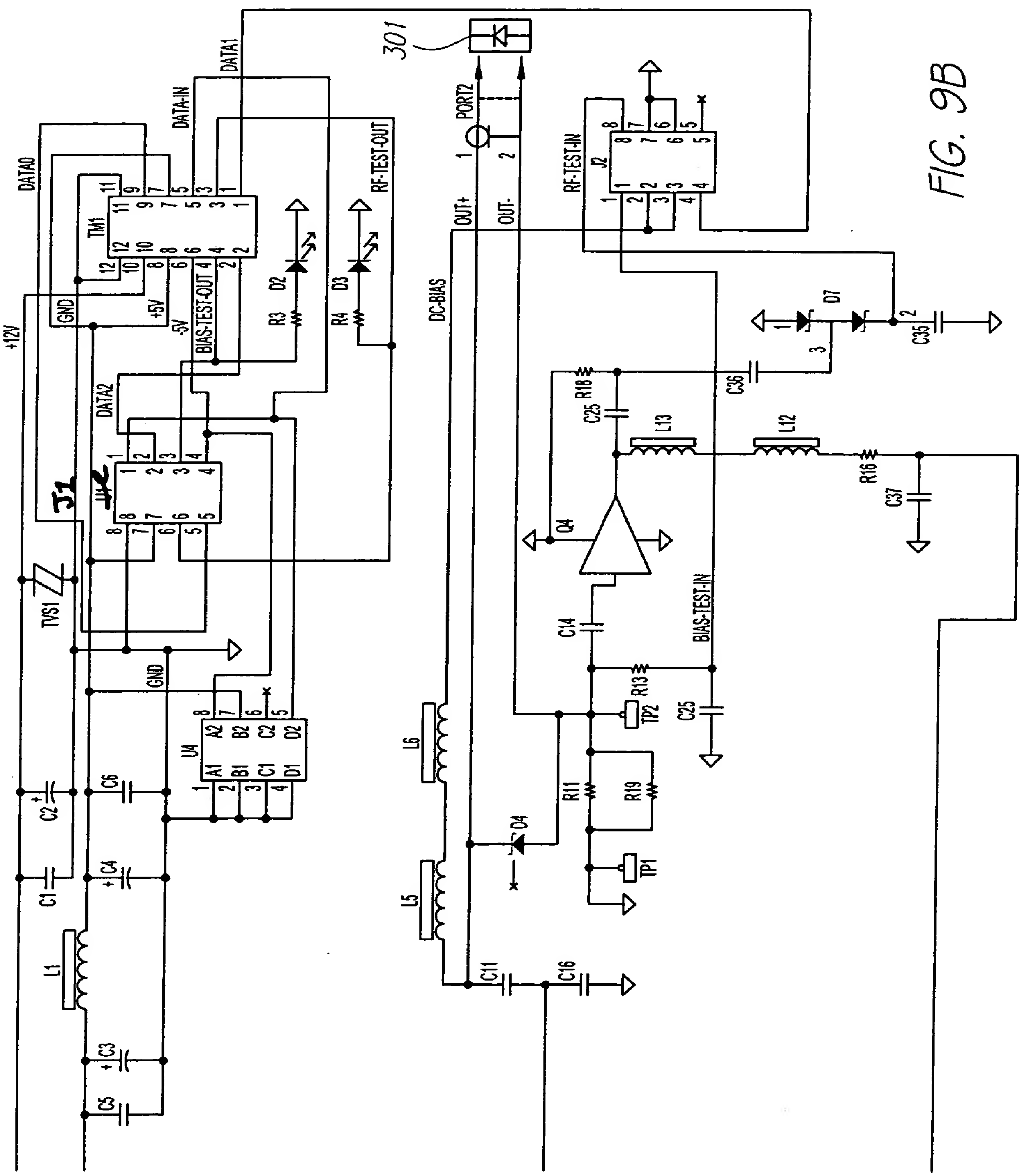
MARKED UP VERSION TO SHOW CHANGES MADE

IN THE SPECIFICATION

In the paragraph starting on page 32, line 7:

The output drive current of the power amplifier Q3 to the laser diode is adjusted to the nominal operating point of the laser diode by adjusting the gate voltage at the input of the power amplifier Q3. The gate voltage is controlled by a first integrated circuit U3 and a potentiometer R6. The first integrated circuit U3 is preferably a [CD4061BCM] <u>CD4051BCM</u> or similar device. The gate voltage is derived from a supply voltage regulated by a zener diode D1 to achieve a highly stable bias voltage regardless of power supply voltage fluctuations. The power amplifier stage Q3 is AC-coupled with the gate voltage such that the voltage waveform at the input results in a linear modulation of the laser drive current at the output. Therefore, the low impedance laser diode 301, being essentially a current-controlled device that linearly converts input current to output optical power, is driven by the voltage controlled power amplifier Q3 which resides in the low impedance power amplifier stage of the laser driver 300. The input and the output of the power amplifier Q3 are AC-coupled, and the output to the laser diode 301 is provided with an appropriate dc bias current such that the output modulation of the power amplifier Q3 causes the laser drive current to swing from nearly off to the desired output power with an optical output power extinction ratio of at least 10:1. In designing the bias circuit, consideration may be given to selecting minimum, maximum, and average power levels for the laser diode 301, as bias current causes the laser to operate at a selected average

power level, and the wideband signal modulation will cause the laser output to vary between the power level extremes.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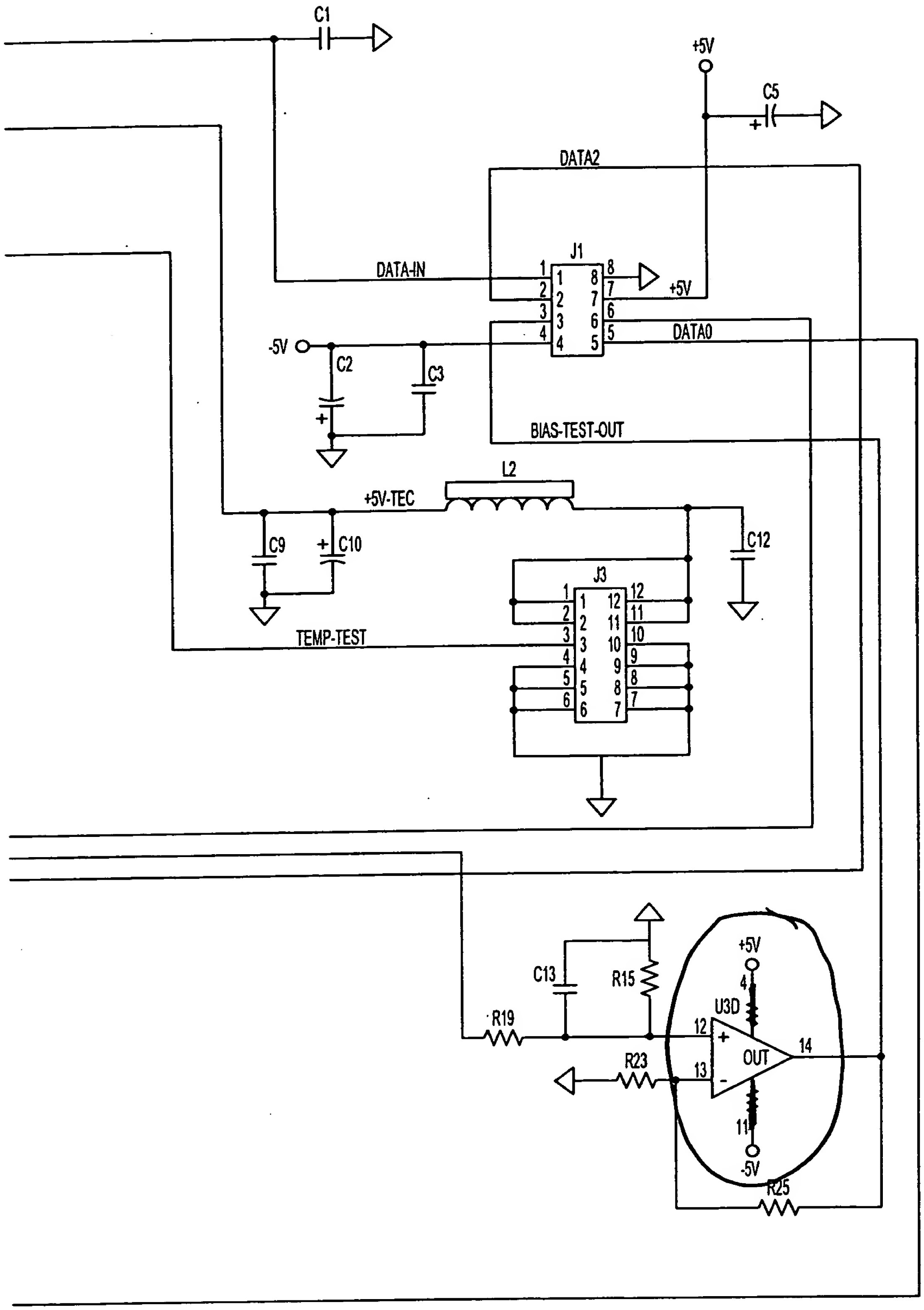
BIAS-TEST-OUT
DATA2
D2
D3
R3
R4
DC-BIAS
OUT+
OUT-
D7
C35
R18
C25
L13
L12
C36
R16
C37
Q4
TVS1
U4
C14
BIAS-TEST-IN
R13
TP2
L6
C2
C6
R11
R19
D4
TP1
C1
C4
L5
L1
C11
C16
C3
C5

FIG. 9B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DATA-IN
+5V
DATA0
-5V
C2
C3
BIAS-TEST-OUT
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+5V-TEC
C9
C10
C12
J3
TEMP-TEST
C13
R15
R19
U3D
+5V
OUT
R23
-5V
R25

FIG. 10C